

MARINE BIODIVERSITY OBSERVATION NETWORK

SANTA BARBARA CHANNEL



***Marine Science Institute
University of California Santa Barbara***

Who we are

Principal/Associate Investigators

UCSB

Robert Miller, David Siegel, Craig Carlson, Daniel Reed, BS
Manjunath, Deborah Iglesias-Rodriguez, Doug McCauley, Milton Love

Florida State University

Andrew Rassweiler

USGS

Kevin Lafferty

UCSD - SIO

John Hildebrand

NOAA – NMFS SWFSC

Andrew Thompson





Partners

Plumes and Blooms

BOEM Pacific Region

Channel Islands National Marine Sanctuary

Southern California Coastal Water Research Project

Santa Barbara Coastal LTER

**Southern California Coastal Ocean Observing
System (SCCOOS)**

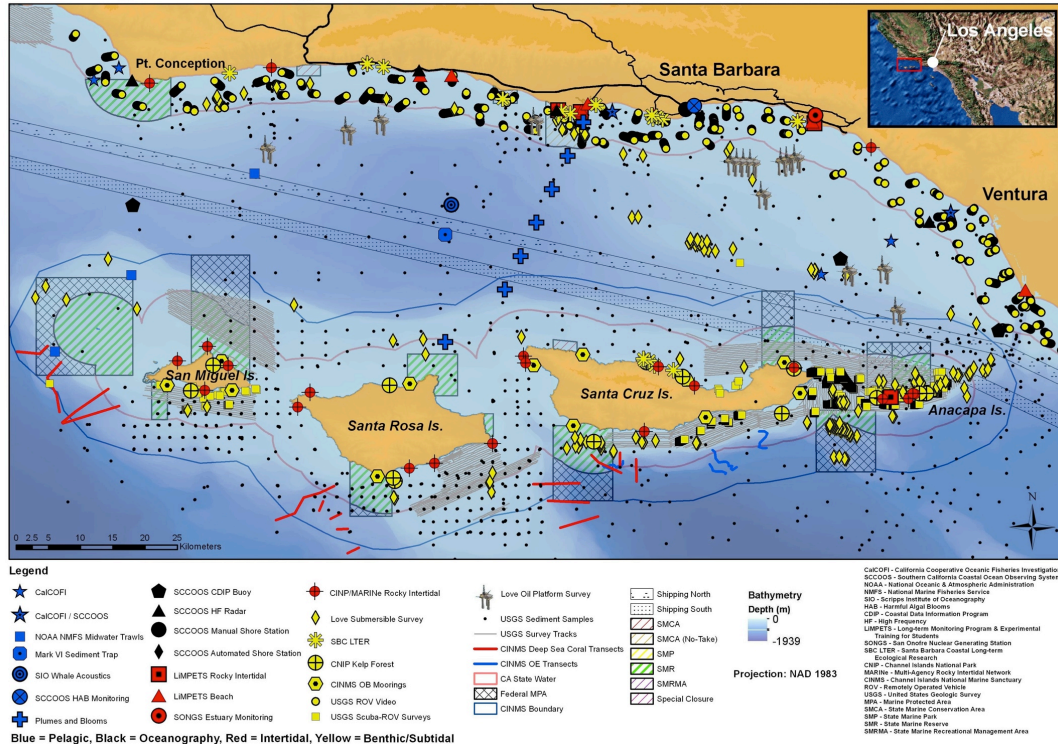
Channel Islands National Park

Gray Whales Count

CalCOFI

Existing Monitoring Partners

Santa Barbara Channel, California



MBON Prototype:

1. Provide data to inform managers and society about patterns of biodiversity across taxa, space, and time
 - *Integrate existing data*
 - *Develop new methods & products*
2. Build a replicable framework to allow MBON production under diverse circumstances

Data Integration and Delivery

Focus on ongoing time-series

oldest: 34 yrs

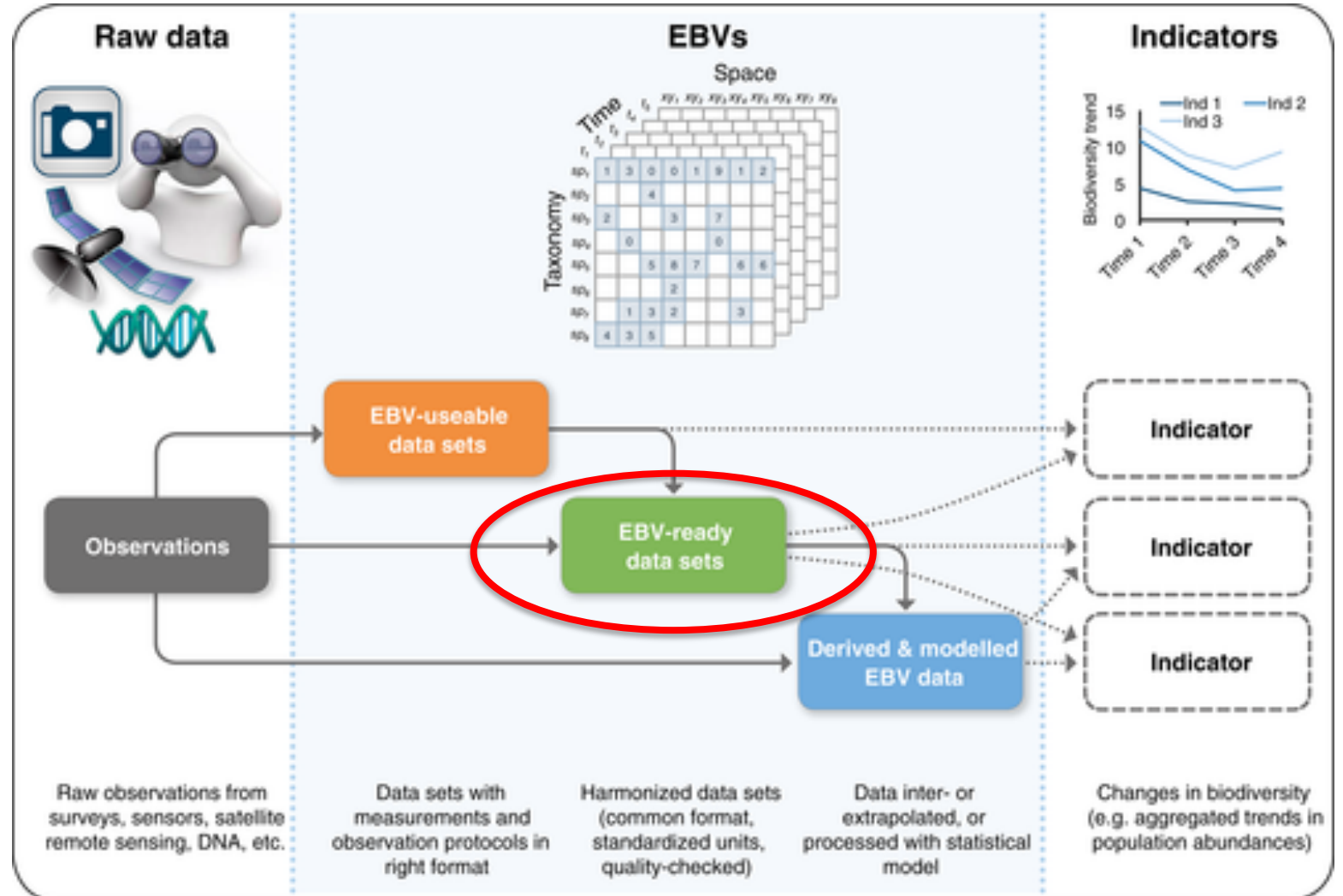
youngest: 17 yrs

13 Data packages published

stable, immutable with DOI

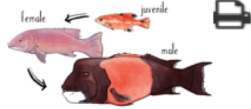
Data spanning taxa from microbes to whales

Reproduced from Kissling et al 2017, Figure 1.

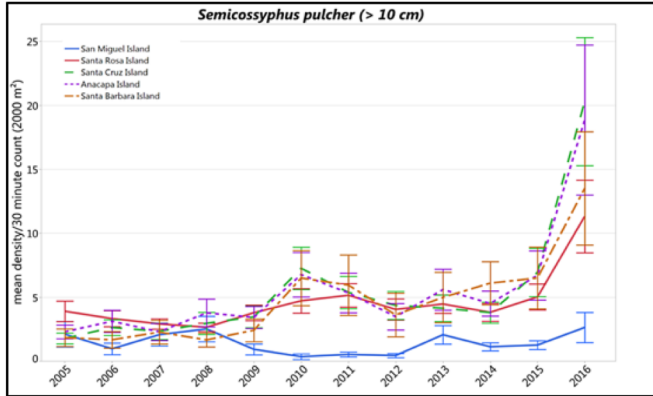


California Sheephead Abundance in CINMS

The California sheephead (*Semicossyphus pulcher*) is a large and beautiful fish that plays an important role in the food web of kelp forests and rocky reefs in southern California. Sheephead are also a popular sport fish for recreational and commercial fishing and a draw for SCUBA divers.

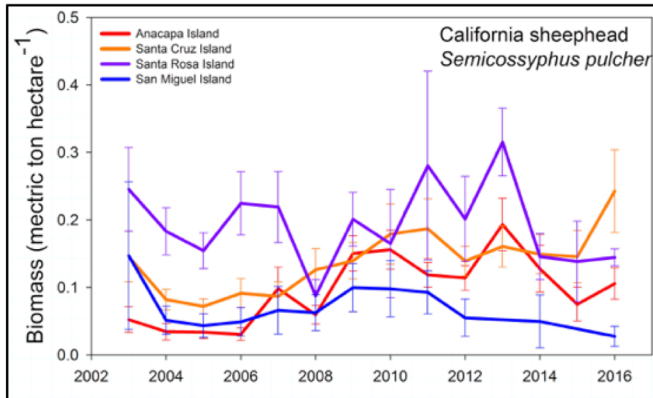


Abundance of California Sheephead



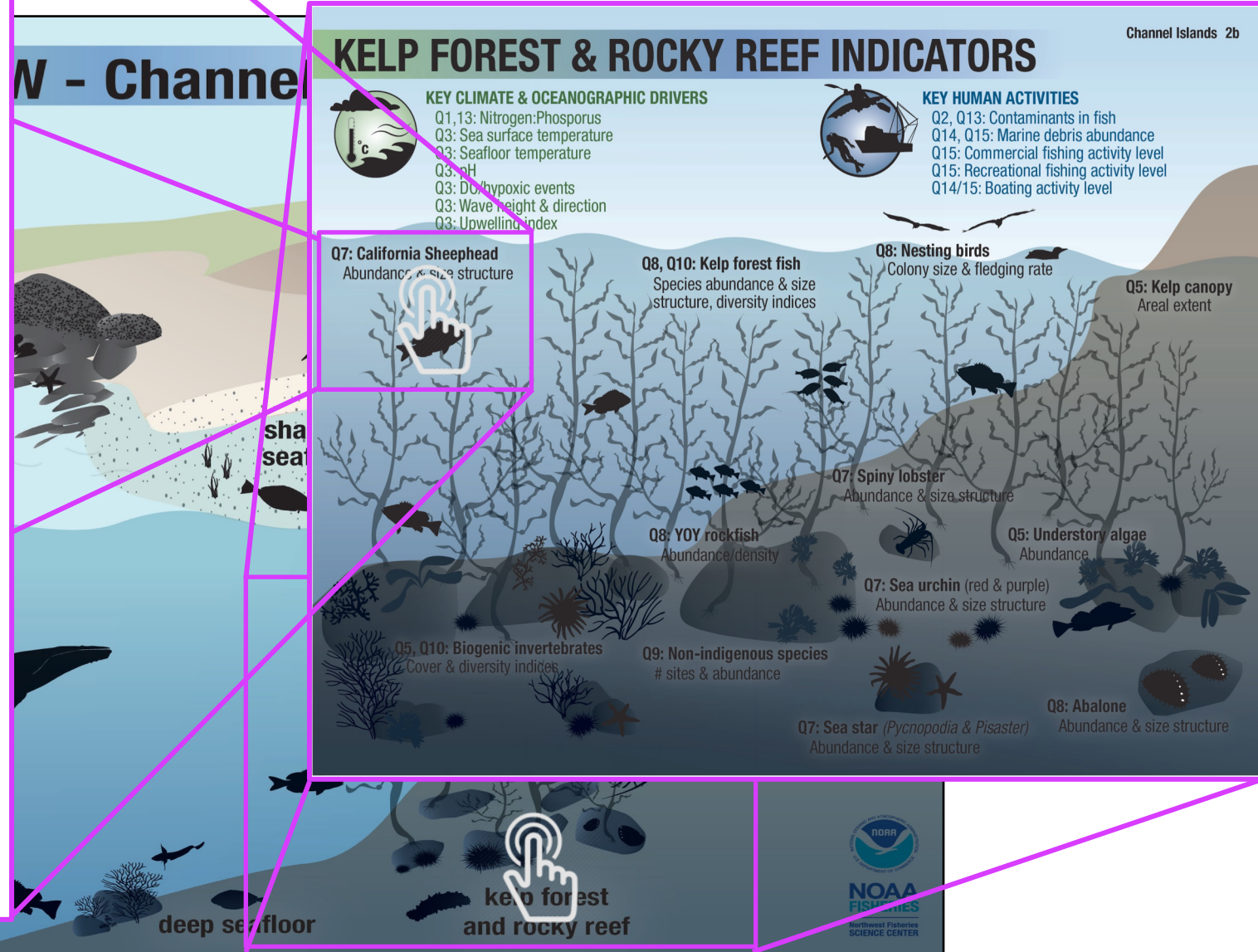
Average density of California sheephead at Channel Island National Park kelp forest monitoring sites at the five islands in CINMS. Sheephead density was averaged across all monitoring sites at each island to examine overall sanctuary trends. Note that juveniles (< 10 cm) were excluded from analysis.

Abundance of California Sheephead



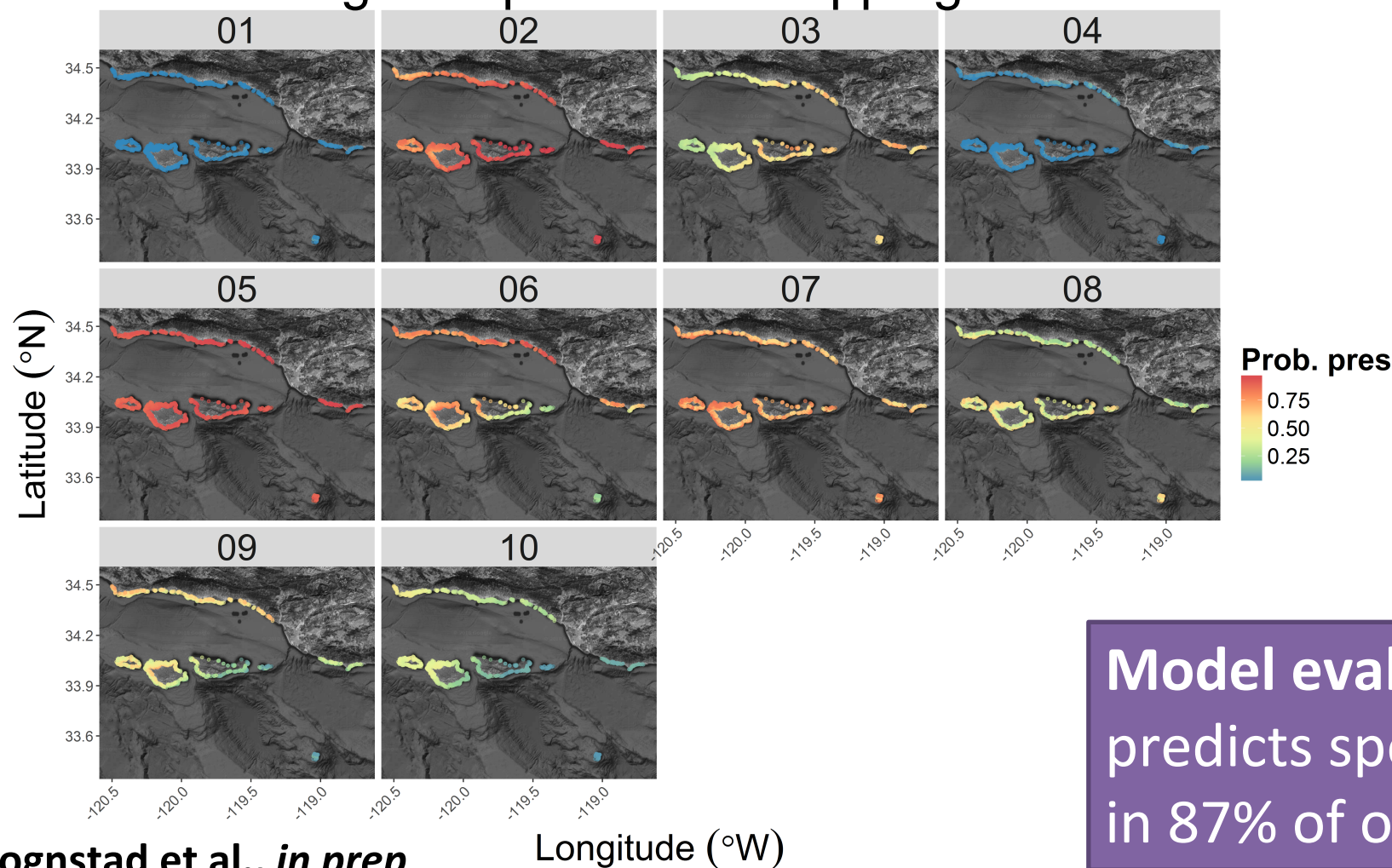
Average density of California sheephead observed by SCUBA divers at 14 sites across four islands in CINMS monitored by the PISCO kelp forest monitoring program. Observed density was averaged across all monitoring sites at each island to examine overall sanctuary trends.

Sanctuary Condition Reports



Species Archetype Modelling (SAM) identifies nine archetypes, **SST** and **wave height** important predictors

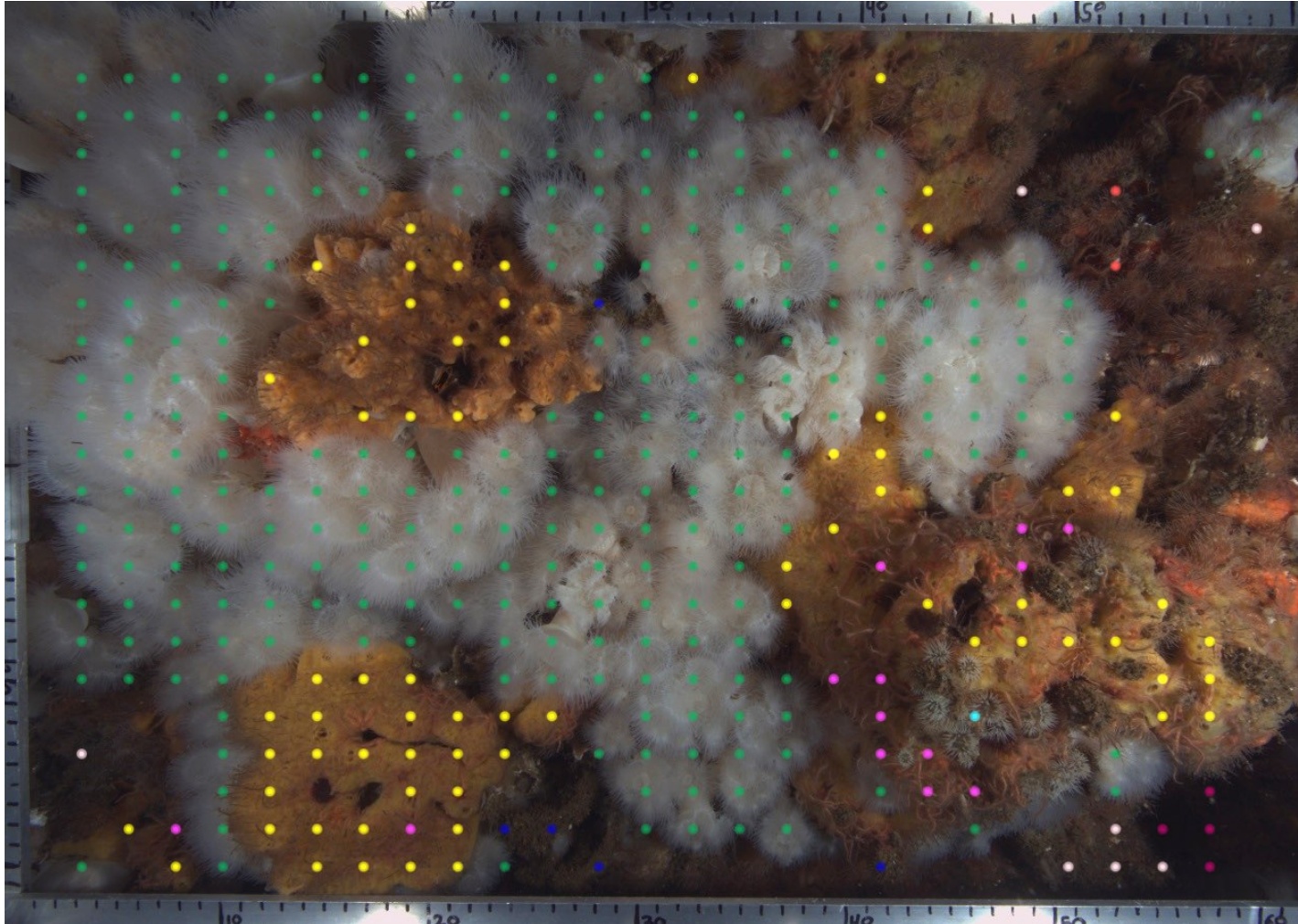
Regional prediction mapping



Model evaluation: Correctly predicts species presence/absence in 87% of observations

New Products: Deep learning for image analysis

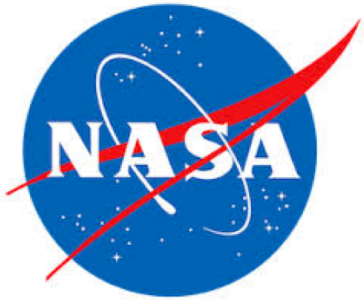
Percent cover at 95% confidence



Top performers

Samples	Accur...	Error...	F1 %	Label
2140	100.0	0.0	100.0	Rhodophyta - Ahnfeltiopsis linearis
1830	100.0	0.0	100.0	Rhodophyta - Calliarthron tuberculosum
1180	100.0	0.0	100.0	Ectoprocta - Crisia sp B unidentified
1106	100.0	0.0	100.0	Ectoprocta - Cellaria spp
507	100.0	0.0	100.0	Annelida - Pista elongata
2741	100.0	0.2	99.6	Echinodermata - Ophiothrix spiculata
4590	99.6	0.0	99.6	Cnidaria - Paracyathus stearnsii
2920	99.3	0.0	99.3	Ectoprocta - Phidolopora labiata
3630	99.8	0.4	99.2	Cnidaria - Muricea californica
1660	99.0	0.1	98.8	Cnidaria - Anthopleura elegantissima
803	100.0	0.1	98.8	Ectoprocta - sunflower encrusting bryozoan uni...
4760	99.2	0.1	98.7	Cnidaria - zoanthid unidentified
1290	100.0	0.7	98.6	Echinodermata - Apostichopus parvimensis
1570	98.1	0.0	98.1	Chordata - Trididemnum opacum
1350	100.0	0.3	97.7	Rhodophyta - Laurencia pacifica
4200	97.6	0.0	97.6	Echinodermata - Patiria miniata
2340	97.6	0.0	97.6	Rhodophyta - Plocamium cartilagineum subsp ...

BisQue

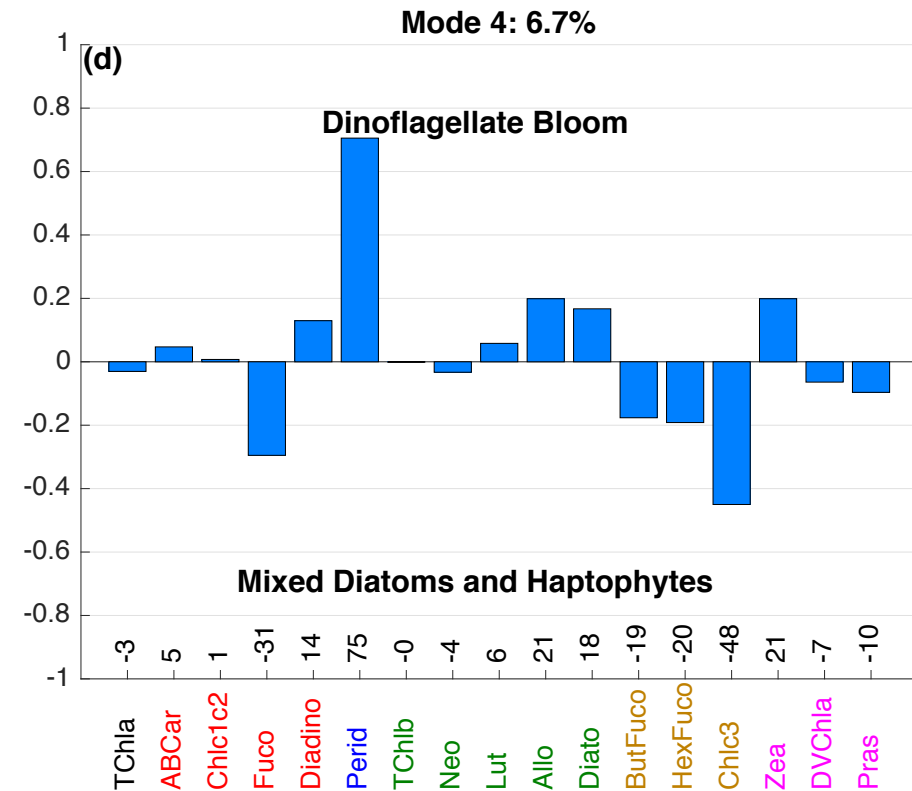
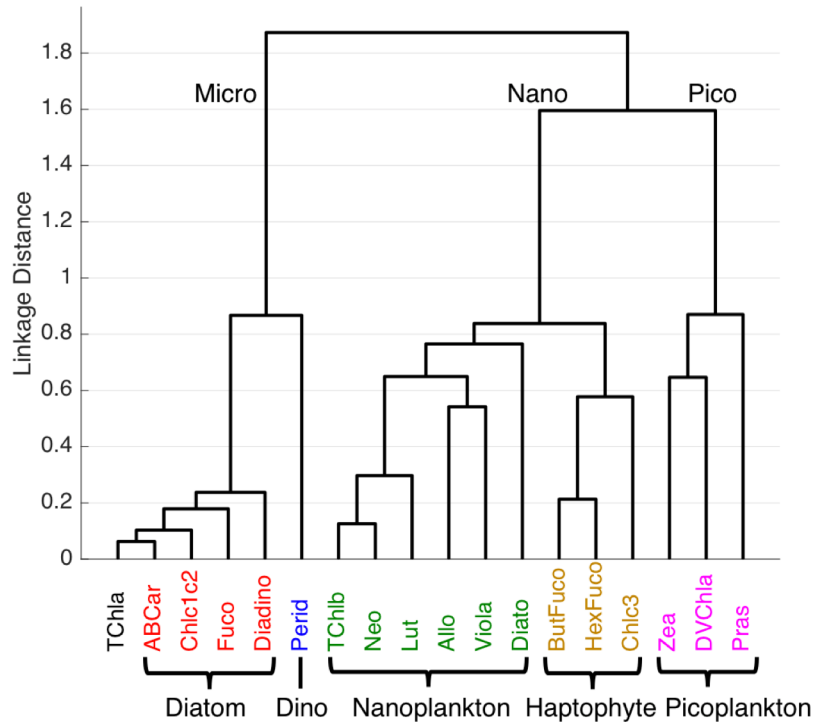


New Products: Remote Sensing

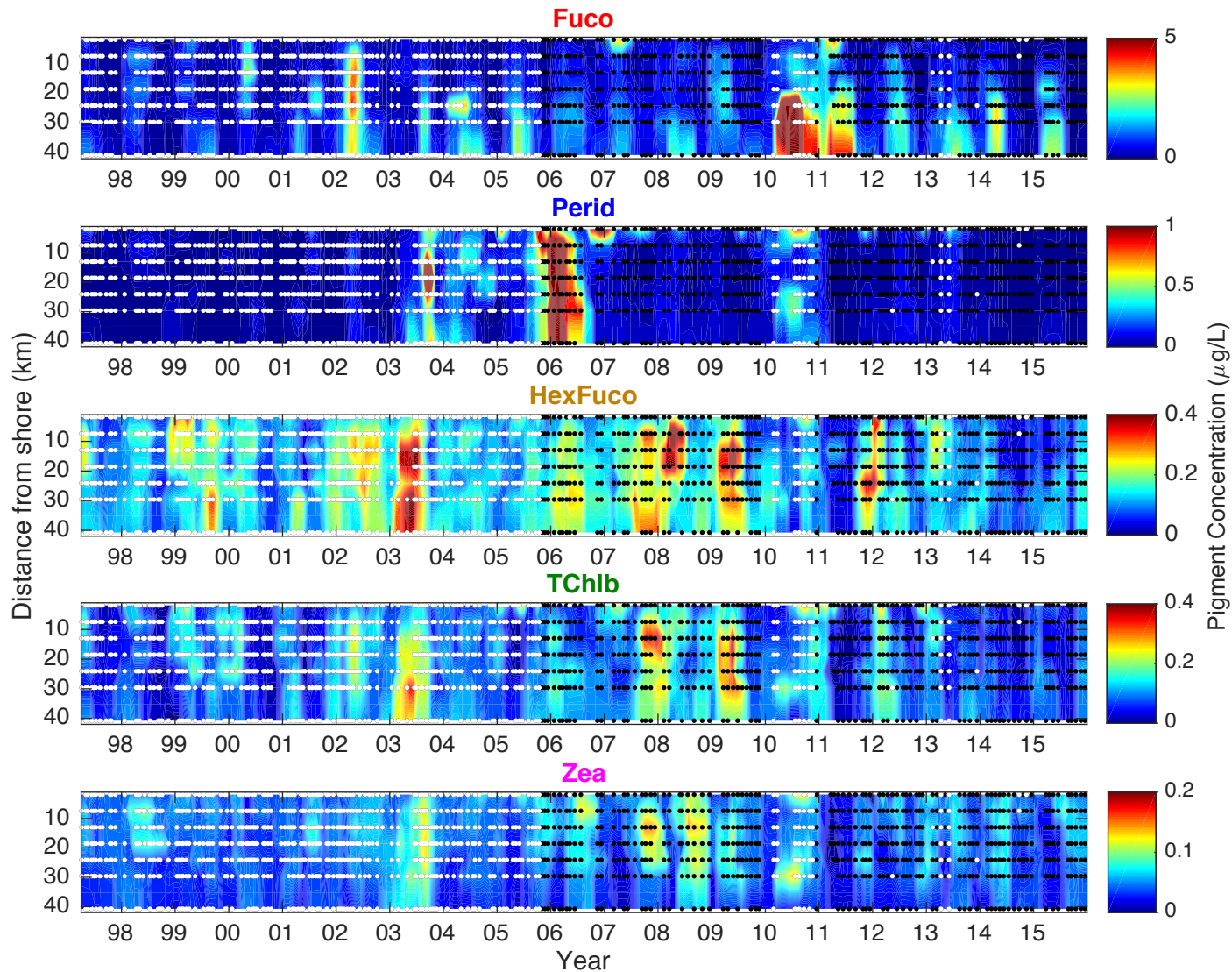
Phytoplankton functional diversity

Phytoplankton Pigment “Communities”

Pigment communities defined with cluster, EOF analyses as proxy for PFTs



Bio-Optical Models Extend Biomarker Pigment Time Series



Model Retrievals	R ²
TChlb (green algae)	0.815
HexFuco (haptophytes)	0.733
Fuco (diatoms)	0.856
Perid (dinoflagellates)	0.887
Zea (picoplankton)	0.541
Pigment EOF Mode 1 (Early upwelling mixed bloom)	0.884
Pigment EOF Mode 2 (Diatoms vs. mixed nano-/pico-plankton)	0.852
Pigment EOF Mode 3 (Pico-plankton vs. haptophytes)	0.454
Pigment EOF Mode 4 (Dinoflagellates vs. mixed diatoms/haptophytes)	0.809

New Products: Genomics

Microbial diversity & community structure

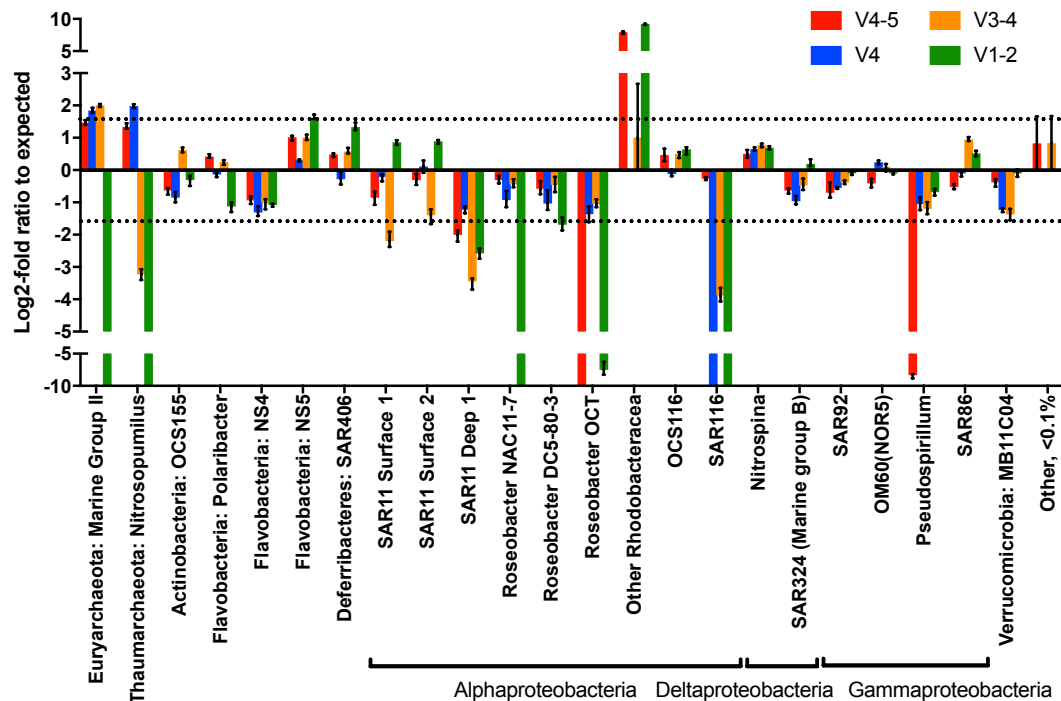
environmental
microbiology



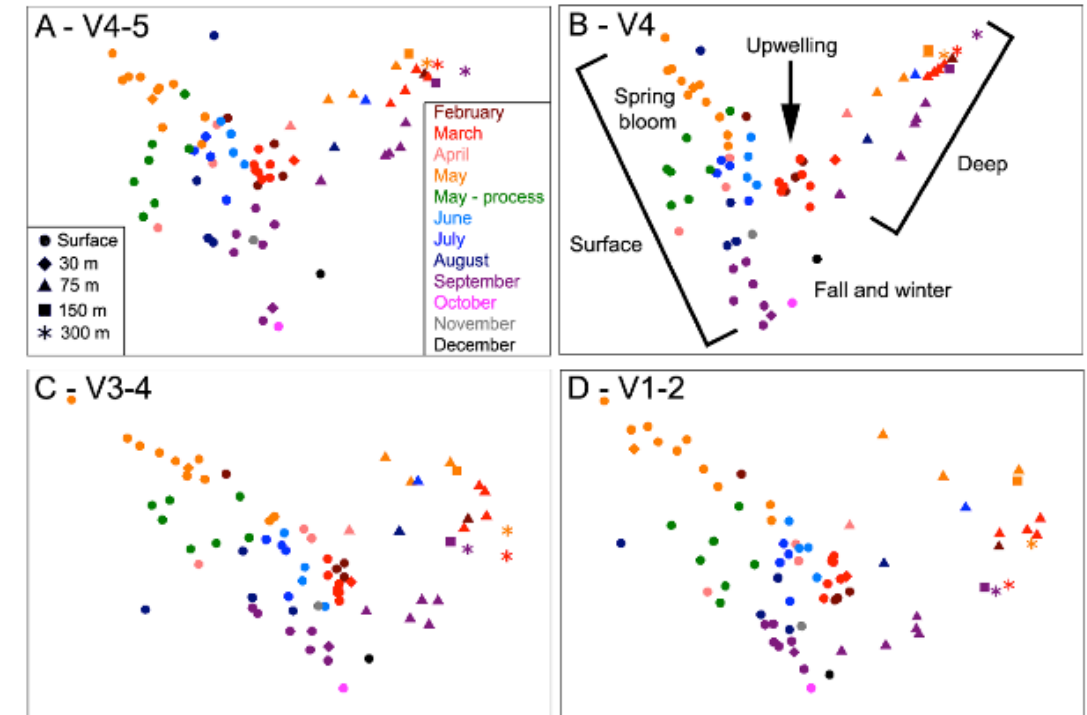
Environmental Microbiology (2018) 00(00), 00–00

doi:10.1111/1462-2920.14091

Mock community deviation from expected abundance with four different primer sets:



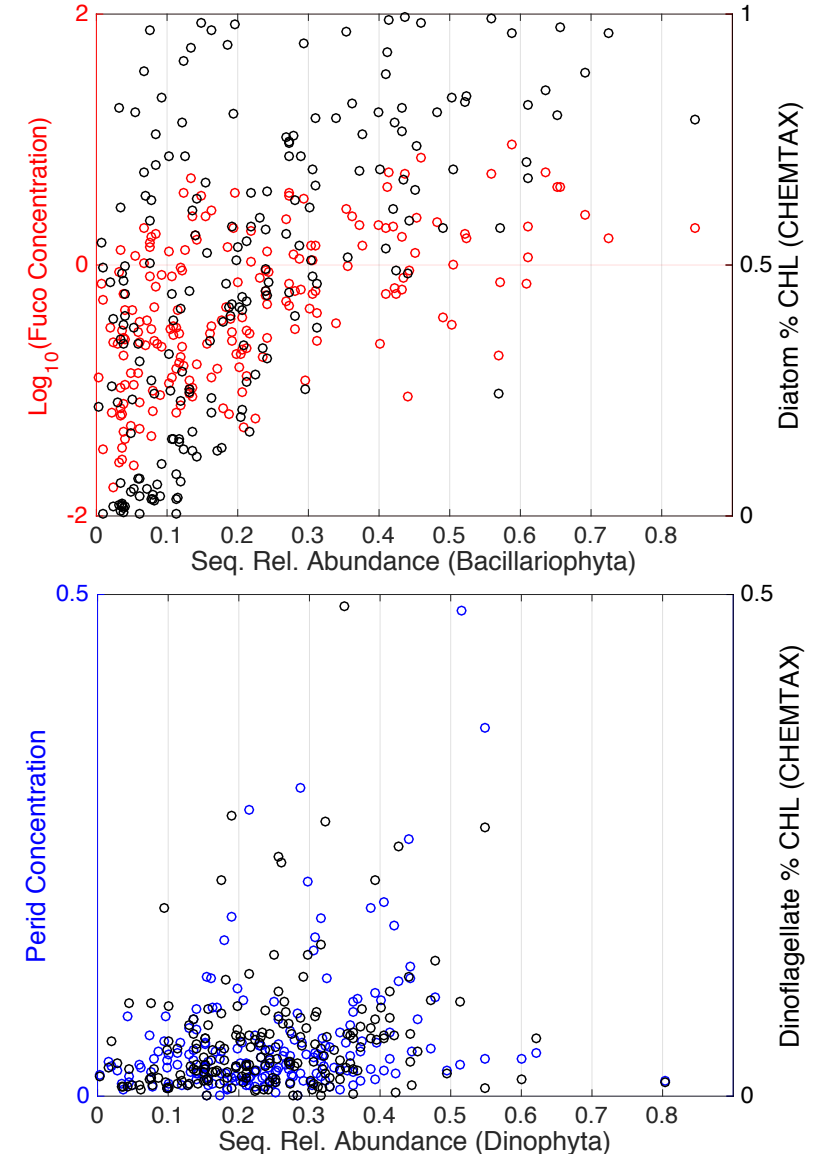
Ordination plots of the same marine time-series samples sequenced with four primer sets

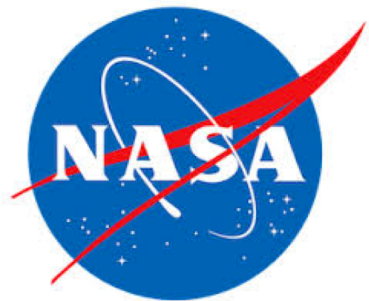


Wear et al. 2018

Linking Genomics and Bio-optics

- Mock communities developed for testing methods
- Lots of work left to answer these questions:
 1. Can we derive PFT indices from sequences?
 2. Do they align with pigment PFTs?
 3. Can we use PFTs to predict microbes?





New Products: Remote Sensing

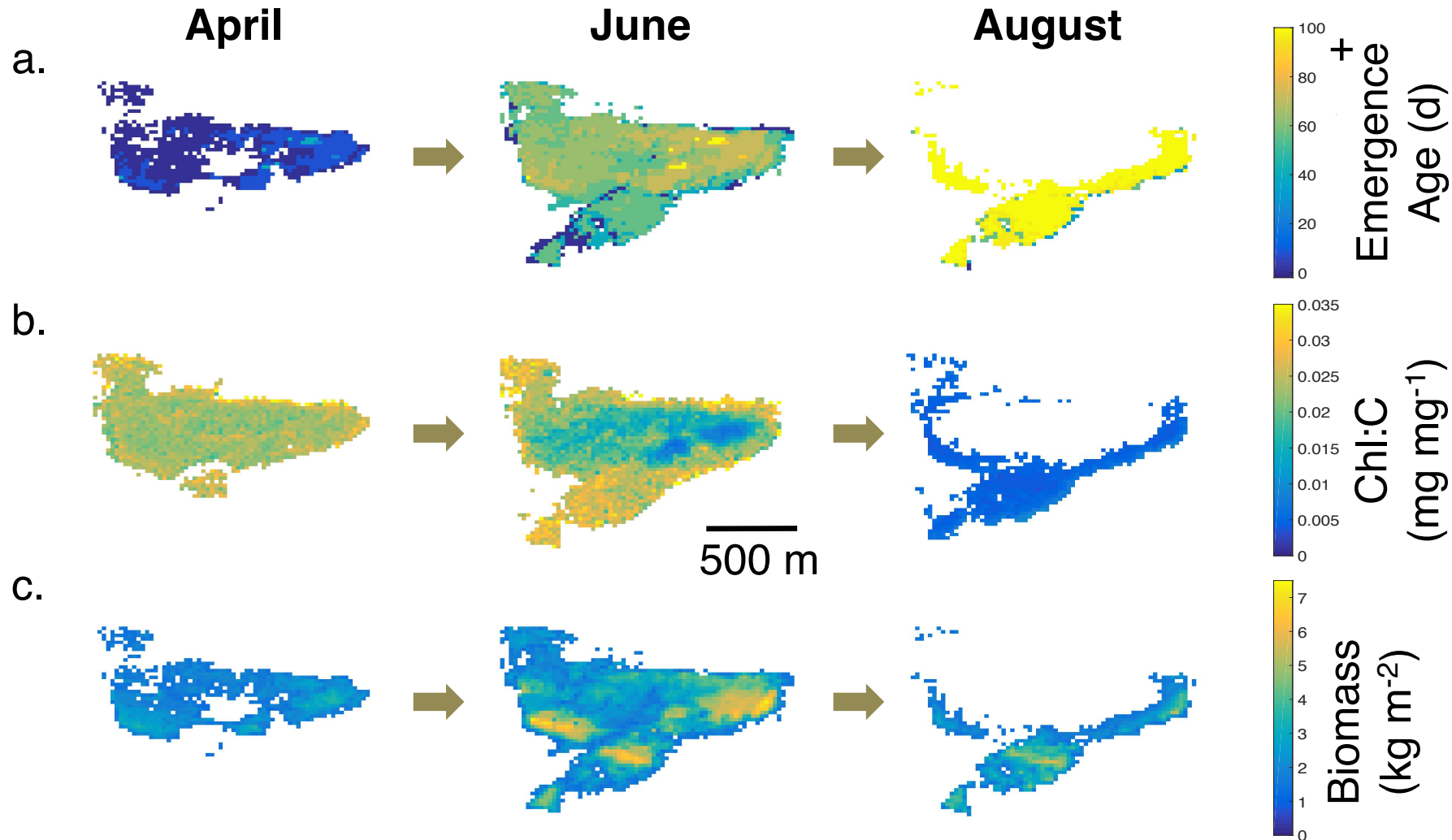
Kelp condition, age, and forest extent



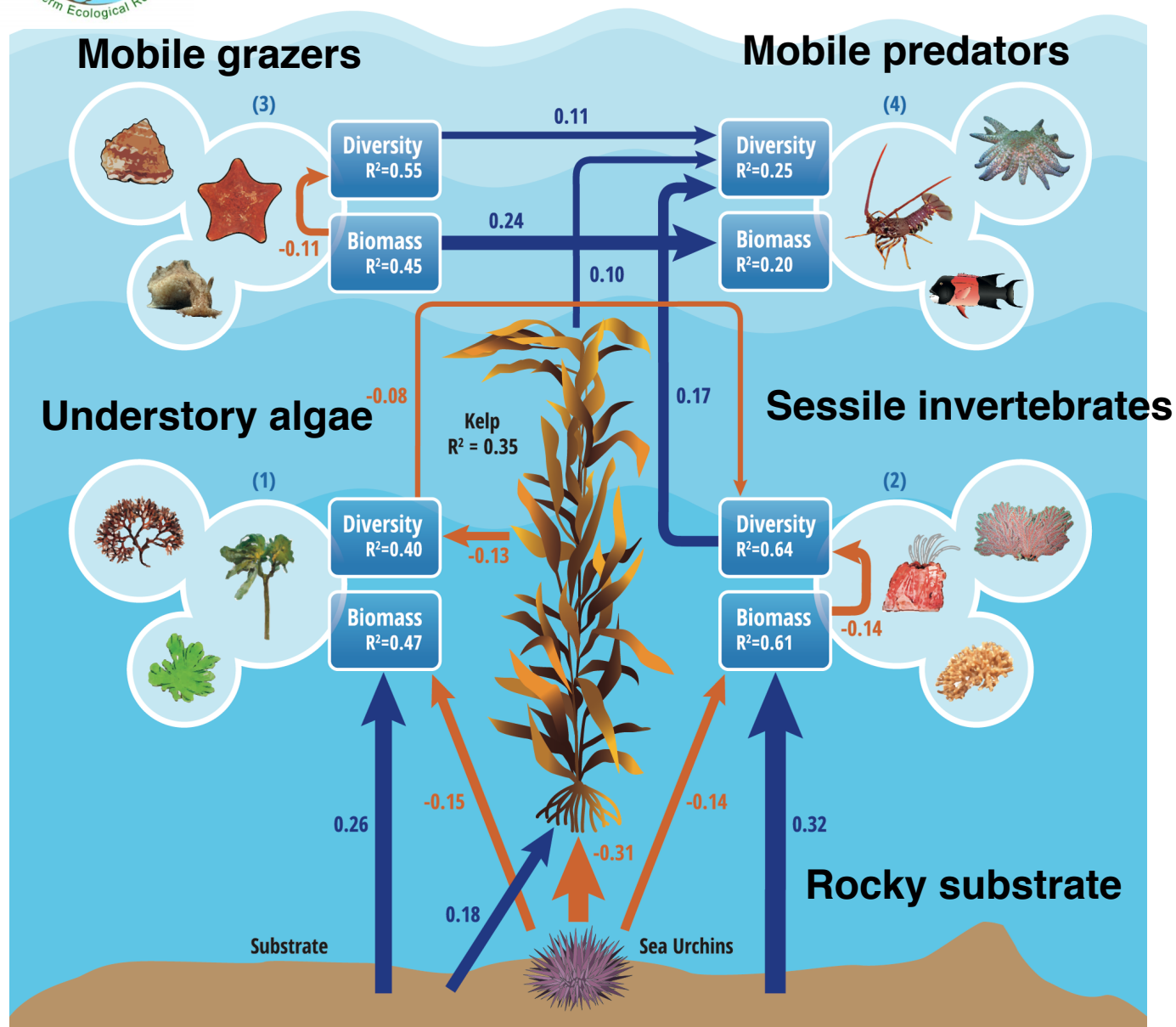
AVIRIS
Airborne Visible / Infrared Imaging Spectrometer



Bell & Siegel in prep
Bell et al. L&O 2018

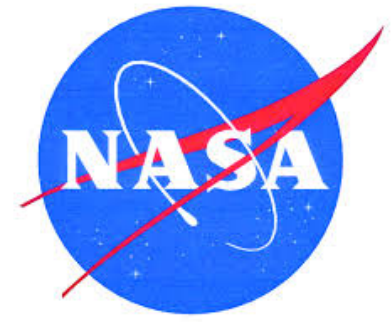


What does kelp data tell us about broader biodiversity?



Giant kelp increases biodiversity through physical engineering

Kelp positively affects kelp forest species richness, especially sessile invertebrates and mobile predators



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